



EXPLORING PREPAID ELECTRICITY ADOPTION AT NATIONAL HOUSING AUTHORITY RESETTLEMENT SITE: BASIS FOR POLICY RECOMMENDATION

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Abstract

Globally, prepaid electricity systems offer potential benefits for energy management and equitable access. However, there is still a significant knowledge gap in the Philippines regarding the adoption and impact of these systems, especially regarding challenges and experiences of local users, such as those in marginalized communities. Hence, this study investigates the implementation of prepaid electricity systems at the National Housing Authority (NHA) Resettlement Site in Caloocan City for the fiscal year 2024. The study evaluated the challenges, benefits, and satisfaction of residents and the perspectives of the implementing agency to inform policy recommendations. Using a convergent parallel mixed-methods design, the study gathered quantitative data from 103 residents and 9 technical staff and qualitative data from 20 residents and the agency's technical unit head. Results indicate high satisfaction with flexibility (Mean = 3.55) and reliability (Mean = 3.52), but moderate concerns about affordability (Mean = 3.43) and availability (Mean = 3.44) due to hidden fees and technical issues. Qualitative feedback supported these trends, revealing challenges with service interruptions and cost transparency. Project management was rated highly in planning and monitoring (Mean = 3.63), but lower in implementation (Mean = 2.97). The study recommends policies promoting service efficiency, pricing transparency, and financial literacy to improve prepaid electricity systems for marginalized communities.

Keywords: prepaid electricity, user satisfaction, marginalized communities, project management, policy recommendation, energy access

Introduction

Electricity is now the lifeblood of modern society. Different government agencies and utility sectors continually study and improve their policies and the delivery of their services to accommodate the changing demands of people. The global push toward sustainable and efficient energy consumption has ignited considerable interest in alternative electricity payment models. One such model, prepaid electricity adoption, has gained prominence for its potential to enhance energy management and provide more equitable access to electricity. However, it is essential to recognize that the implementation and impact of prepaid electricity adoption vary significantly from country to country, highlighting the need for thorough exploration.

Prepaid electricity systems have been implemented across various continents, offering a diverse range of experiences that highlight both unique challenges and shared outcomes. In Africa, countries such as Kenya and South Africa have extensively adopted prepaid meters. Kenya, in particular, has showcased significant improvements in revenue collection as a result of this technology (Wangui, 2019). Meanwhile, South Africa faces challenges in ensuring affordability for low-income households, necessitating tailored subsidies and tariff structures (Kambule & Nwulu, 2021). In Asia, Bangladesh has successfully leveraged prepaid electricity systems to reduce outstanding debts and enhance user convenience which demonstrate the potential of the technology to address financial and operational challenges (Rabbani et al., 2020). This suggests that the prepaid intervention has a significant impact on decreasing retail delinquency and influencing customer behavior. In Europe, Germany's experience reveals that prepaid systems enhance their awareness of electricity costs and adapt their behavior to save electricity. Enhanced cost transparency plays a pivotal role in driving this transformation with customers reporting promising levels of satisfaction with prepaid electricity systems (Alao, 2022). Prepaid electricity systems vary in impact across countries, emphasizing the necessity for continuing policy assessment and improvements tailored to each nation's requirements.

In the Philippines, a notable gap exists within the scope of research, as there is a distinct absence of local studies addressing the subject of prepaid electricity adoption. The lack of such research creates a significant knowledge gap, hindering thorough insight into the complexities of adopting prepaid meters. Therefore, this research is crucial as it aims to illuminate a subject that has yet to be thoroughly investigated. Compounding this research gap is the novelty of prepaid meters in the Philippines, whose availability remains limited and is yet to be widespread nationwide. Failure to examine this realm will leave people in perpetual ignorance, hindering them from genuinely discovering the experiences and circumstances of those relying on prepaid electricity in the Philippines.

To truly grasp the intricacies of prepaid electricity, the research will thoroughly explore and uncover valuable insights at the National Housing Authority (NHA) Resettlement Site. It is crucial to actively participate in open dialogues with residents and officials of NHA to gather their perspectives and gain a comprehensive understanding of the various emotions and beliefs associated with the existing system. Alongside this, the research

will capture actual experiences in real-life situations, encompassing both positive and challenging experiences, to produce a genuine representation of everyday interactions with the prepaid mechanism. From the data and narratives, the user's level of satisfaction will be known, and the recurring themes will be identified to guide the recommendation of suitable policies. The aim is not just academic understanding but to pave the way for an improved system that creates a platform that empowers every Filipino.

The number of prepaid electricity users in the Philippines has increased from over 20,000 since the Energy Regulatory Commission's approval in May 2015 to 101,941 customers, as indicated by Meralco's 2019 Annual Report. The service is accessible in residential areas, including Pasig, Manila, Makati, and Mandaluyong. Additionally, it caters to the communities in the municipalities of Cainta, Angono, Taytay, and Binangonan within the province of Rizal. Furthermore, the service extends to selected zones within Novaliches, Caloocan, San Juan, Taguig, Pasay, Paranaque, Cavite, Bulacan, and Tagaytay. Meralco had outlined preparations for its expansion to include additional regions in 2020. This remarkable development highlights the need for a comprehensive research investigation to explore the effects and potential of prepaid electricity in offering significant support to Filipinos in effectively addressing their electricity requirements.

Seeing the profound impact of prepaid electricity, especially in the resettlement site of the National Housing Authority, has inspired me to delve deeper into this subject. It's more than just a research interest; it's a personal calling to be a part of meaningful solutions in sustainable and accessible energy. This research topic resonates deeply because it perfectly bridges the engineering and social welfare gap. Moreover, in the context of the master's in engineering management program, this research subject embodies the program's core values. It mirrors the ethos of applying engineering principles to real-world challenges, where technological progress goes hand in hand with social inclusivity. This exquisitely reflects the program's interdisciplinary approach and unwavering commitment to nurturing forward-thinking engineering leaders who can make a tangible difference in our world.

Objectives of the Study

This study aims to explore the adoption of prepaid electricity at the National Housing Authority Resettlement Site in Caloocan City during the fiscal year 2024, with the ultimate goal of generating policy recommendations. Specifically, the study seeks to:

1. Identify the specific challenges and benefits encountered by users in adopting prepaid electricity.
2. Examine the impact of prepaid electricity, as observed by the implementing agency, on the quality of life of the end users.
3. Describe the project management of prepaid electricity at the NHA resettlement site in terms of:
 - 3.1. application,
 - 3.2. planning,
 - 3.3. implementation, and
 - 3.4. monitoring and evaluation.

4. Assess the level of client satisfaction regarding the adoption of prepaid electricity.
5. Formulate policy recommendations based on the overall findings of the study.

Conceptual Framework

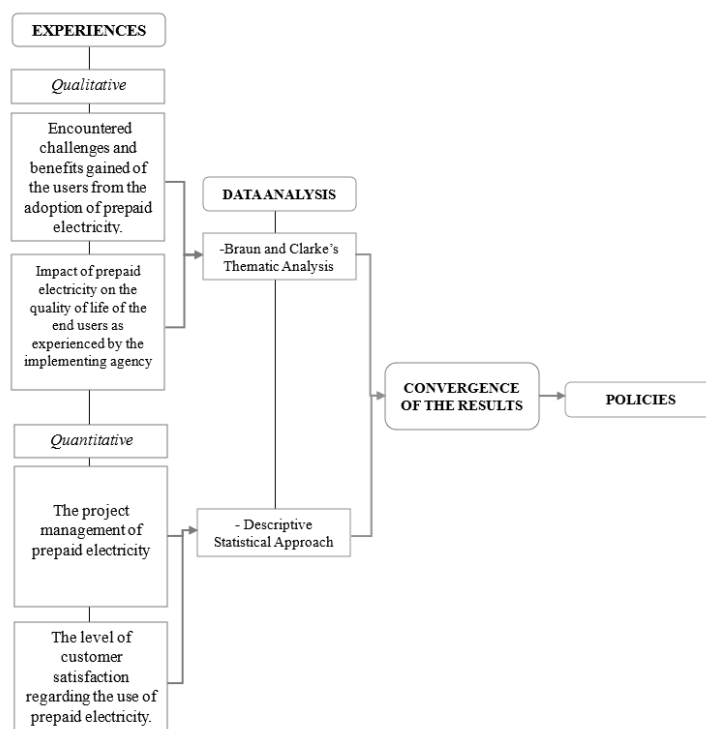
Figure 1 illustrates the research paradigm used in the study. It begins with the exploration of challenges, benefits, and customer satisfaction related to the adoption of prepaid electricity. These experiences form the foundation for understanding how prepaid systems impact both users and providers. Data were collected through in-depth interviews and survey questionnaires, allowing for a combination of qualitative and quantitative insights. Braun and Clarke's Thematic Analysis was applied to identify key themes from the qualitative responses, while descriptive statistics (mean and standard deviation) were used to analyze Likert-scale survey results. The primary outcome of the study is a comprehensive set of insights into the implementation of prepaid electricity, which serves as a basis for informed decision-making and policy formulation.

Methods

Research Design

This study employed a convergent parallel mixed-methods design to comprehensively explore the adoption of prepaid electricity at the NHA Resettlement Site in Caloocan City.

Figure 1. Conceptual Framework



Quantitative and qualitative data were collected simultaneously, analyzed separately, and then merged for interpretation. This design was chosen to investigate both the measurable satisfaction levels and the lived experiences of users and the implementing agency (Sharma et al., 2023). The quantitative phase utilized a 4-point Likert scale to assess satisfaction levels of 103 residents and 9 technical staff, while the qualitative phase involved semi-structured interviews with 20 residents and the agency head, exploring deeper insights into challenges, benefits, and program management.

The research was grounded in pragmatism, which supports the use of both qualitative and quantitative methods to solve real-world problems (Ponce, 2022). The mixed-methods approach ensured a well-rounded analysis by capturing numerical trends and personal experiences. Quantitative data were processed using descriptive statistics, while qualitative data were analyzed thematically using Braun and Clarke's framework. The integration of these methods allowed for triangulation, enhancing the validity of findings and supporting the formulation of policy recommendations to improve prepaid electricity implementation in resettlement areas.

Population and Sample of the Study

The study employed a combination of purposive and simple random sampling to select participants for both qualitative and quantitative phases. For the qualitative component, purposive sampling was used to select the team head of the NHA Caloocan District Office technical unit, who oversaw the prepaid electricity project from construction to implementation. This approach ensured insights from an individual with deep knowledge of the program (Obilor, 2023). In addition, 30 residents from Tala II Residences were chosen through simple random sampling, with the site selected due to its longer implementation period compared to neighboring areas.

To ensure relevance, residents met specific inclusion criteria: they must be legitimate NHA awardees, have lived at the site for at least three years, and have actively used prepaid electricity since relocation. Exclusion criteria were based on NHA Memorandum Circular 2021-021, which restricts non-awardees from formal participation. Out of the 30 residents, 20 were interviewed based on data saturation principles (Malterud et al., 2016).

For the quantitative phase, only 84 resident respondents were required using simple random sampling, as computed via the G*Power Calculator; however, 103 respondents actually participated. Nine technical staff from the implementing agency were also included using total enumeration, ensuring all key project personnel were represented. This methodology allowed for comprehensive, multi-perspective data collection.

Data Collection Procedure

Data collection began with formal permission from the BPSU Graduate School and the NHA Caloocan District Office, including access to the master list of beneficiaries for respondent validation. The process ran from August 30 to September 20, 2024, following a convergent parallel design to gather both quantitative and qualitative data simultaneously.

For the quantitative phase, Google Forms was used to survey residents of Buildings 1 to 7 at Tala Residences II. The form included demographic data, satisfaction levels using a 4-point Likert scale, and recommendations. The HOA was notified, and the survey link was distributed through the official messenger group. A total of 103 resident responses were validated, exceeding the required sample. Likewise, the 9 technical staff members from the implementing agency completed a similar form evaluating project management.

The qualitative phase involved face-to-face interviews with 20 residents using semi-structured guides that covered personal background, experiences, and suggestions. Data saturation was reached with 20 participants. Field notes, analytical memos, and self-reflective journals were maintained to enrich the analysis and support findings. The implementing agency's Technical Head also completed a structured questionnaire, which included project insights and recommendations. All responses were collected with informed consent and safeguarded under the Data Privacy Act of the Philippines.

Methods of Analysis

Both qualitative and quantitative methods were analyzed rigorously to ensure a comprehensive understanding of prepaid electricity adoption at the NHA resettlement site. A research statistician supported the process to strengthen reliability. For qualitative analysis, interview transcripts were coded and examined using Braun and Clarke's Thematic Analysis through MAXQDA. Familiarization with the data included repeated reading of transcripts and listening to recordings, followed by open coding, categorization, and theme development. Subthemes were also identified to provide deeper insights into participant experiences. This process ensured that analysis remained grounded in the voices of participants.

Quantitative data, such as satisfaction ratings, were analyzed using SPSS, Microsoft Excel, and G*Power. A 4-point Likert scale was used to assess satisfaction, with results interpreted through means and standard deviations. Descriptive statistics captured trends in user satisfaction and project management performance. The integration of qualitative themes and statistical findings allowed for a well-rounded analysis, enabling data triangulation and supporting the formulation of evidence-based policy recommendations. This mixed-methods approach provided a holistic view of the adoption experience and outcomes, fulfilling the study's objective of evaluating the system's effectiveness and informing future implementation.

Results and Discussion

The findings are divided into different parts to provide a comprehensive discussion.

Part 1. Experiences of Prepaid Electricity Users

As revealed in Table 1, Participants consistently reported that the prepaid electricity system helped reduce electricity expenses. Comments such as *“Nakakatipid ako sa kuryente”* (Participant 1) and *“Mas mura ang Meralco K-load”* (Participant 15) reflect how users benefit from cost control and monitoring. This supports findings by Lim and de Guzman (2021), who noted that prepaid systems promote lower consumption through real-time monitoring. Cominola et al. (2021) found similar outcomes with smart water meters, which reduced usage by 8%.

Some participants also mentioned receiving rebates for low consumption, enhancing savings and encouraging mindful energy use. For instance, Participant 4 shared, *“May rebate paminsan minsan kung mababa ang konsumo.”* However, others noted that rebates varied with price adjustments. According to Baldwin and Tallackson (2023), rebate programs can motivate consumers to adopt energy-efficient habits, making such schemes a valuable addition to prepaid electricity systems.

It can be observed in Table 2 that the convenience of the prepaid electricity system emerged as a key theme. Participants found it flexible and less time-consuming, especially in payments. For example, one noted, *“Hindi na time-consuming sa pagbabayad ng bill,”* while another appreciated the ease of reloading without visiting Meralco. Mobile payments were also praised for reducing long queues. Prepaid metering enabled better energy management (Maina, 2020), though some users struggled with limited vending points and poor network connections, as seen in Ghana (Lomax & Ritchie, 2024).

Participants also valued the system’s less severe disconnection process. Instead of meter removal during non-payment, users simply lose power when out of load, avoiding major disruptions. As one said, *“Pag wala kang load ay di ka tatanggalan ng metro.”* While this setup supports flexibility for low-income users, Meralco notes that accounts with zero load for 90 days face service termination and meter removal, reinforcing payment discipline (Meralco, n.d.).

In Table 3, the prepaid electricity system has increased consumer awareness and encouraged more disciplined energy use. Participants shared that real-time monitoring helped manage consumption better, as noted by Participant 2: *“Nakakatipid ako sa kuryente kasi monitored ko ang paggamit nito,”* and Participant 3, who learned to use appliances more responsibly. Daily updates and consumption notifications improved awareness, mirroring findings by Sardianos et al. (2020) and Buono et al. (2019), who emphasized the benefits of real-time feedback in promoting efficient energy use.

Table 1. Theme 1 Matrix

Theme 1	Sample Code	Sample Narrative
Cost Efficiency	Electrical Savings	<i>"Nakakatipid ako sa kuryente"</i> (Participant 1)
		<i>"Mas mura ang Meralco K-load"</i> (Participant 15)
	Realistic Rebates	<i>"May rebate paminsan minsan kung mababa ang konsumo, nakakuha ako 200 dati"</i> (Participant 4)
		<i>Nagkakaron kami ng rebate dati lalo na kung maliit lang ang konsumo.</i> (Participant 7)

Table 2. Theme 2 Matrix

Theme 2	Sample Code	Sample Narrative
Convenience	Flexible and Ease Payment Scheme	<i>"Hindi na time consuming sa pagbabayad ng bill."</i> (Participant 2)
		<i>"Mabilis mag reload at di na kailangan pumunta sa Meralco."</i> (Participant 4)
		<i>"Budget friendly kasi kahit 100 lang ay may kuryente na."</i> (Participant 18)
	Less hassle during disconnection	<i>"Pagwala kang load ay di ka tatanggalan ng metro di gaya sa postpaid."</i> (Participant 6) <i>"Kapag hindi kami nagbayad ay hindi tinatanggal ang metro namin."</i> (Participant 11)

Table 3. Theme 3 Matrix

Theme 3	Sample Code	Sample Narrative
Consumer Awareness and Engagement	Towards Responsible Electric Consumer	"Natututo akong maging disiplinado sa paggamit ng mga appliances ko sa bahay." (Participant 3)
		"Nagkaroon ako ng disiplina sa paggamit ng aking appliances sa bahay." (Participant 4)
		"Naging disiplinado kami sa pagkontrol sa paggamit ng appliances." (Participant 11)
	Frequent Updates on Electric Consumption	"Yung notication nila, nauupdate kami sa balance namin araw araw. Namomonitor namin ang konsumo kada araw." (Participant 5)
		"Namomonitor namin ang konsumo sa kuryente at nalalaman ang malalaks kumain ng kuryente na appliances". (Participant 8)
		"May daily notification sa cellphone. Kapag may maintenace ay may notice. Namomonitor ang konsumo sa kuryente." (Participant 19)

Frequent notifications, as noted by Participant 5, allowed users to track daily usage and adjust behavior immediately. However, this advantage may come with a downside. Wohlebbe (2020) pointed out that too many push alerts could overwhelm users, causing "*notification fatigue*" and reducing engagement. While real-time updates foster discipline, excessive alerts may disrupt routines and negatively affect the user experience.

Part 2. Impact of Prepaid Electricity on Users: Insights from the Implementing Agency

A key theme in the prepaid electricity system is improved service delivery and efficiency as presented in Table 4. Residents reported that common electrical issues, like breaker failures, were quickly addressed by the implementing agency. However, more technical concerns such as loading problems and account reconnections, which fall under Meralco's scope, sometimes caused delays. The streamlined KLoad application process—completed in about three days—was also praised for its convenience.

Efficient service is vital across sectors, with parallels in healthcare, business, and public utilities. For instance, intelligent dispatch in hospitals reduced delays from 34% to 3% (Huang

et al., 2024), while Six Sigma methods improve service reliability in businesses (Mathieu," 2022). Such process-focused strategies can also enhance utility services like prepaid electricity.

Despite these improvements, users emphasized the need for better outage protocols, especially during critical times like midnight or extreme weather. Residents valued protection from disconnections in such conditions. Research by Ray et al. (2019) shows that outages beyond two hours during heat waves can pose health risks, while Zhang et al. (2020) advocate for community-based energy sharing systems. Addressing these infrastructure issues is vital to safeguard public welfare and maintain user satisfaction.

Table 4. Theme 4 Matrix

Theme 4	Code	Coded segments
Improved Service Delivery and Efficiency	Management of common issues	<i>"Common issues, particularly electrical failures related to individual breakers, have been effectively managed by the implementing agency, ensuring that residents experience minimal disruptions in service. However, more technical issues, such as loading problems, reconnections for accounts marked as inactive, and changes to contact information, fall under the jurisdiction of Meralco" (Implementing Agency)</i>
	Streamlined Application Process	<i>"The requirements for applying for Meralco's KLoad prepaid electricity are straightforward. Applicants need to visit the nearest Meralco Business Center, present one valid government-issued ID, and fill out an application form. An initial load purchase of at least Php 200 is required for activation, with meter installation completed within three days. Existing customers may only need a valid ID, while new customers might require additional documents like proof of residence. But for this project, NHA applied to Meralco, so the beneficiaries do not need to apply." (Implementing Agency)</i>
	Assurance against disconnections	<i>"Based on the feedback from residents regarding the implementation of the prepaid electricity system, several positive recommendations can enhance its effectiveness while addressing existing concerns. First, to mitigate worries about unexpected disconnections—especially during critical times like midnight, inclement weather, or natural disasters—residents should be assured that their electricity will not be cut off under these circumstances, providing a safety net during financial or logistical challenges" (Implementing Agency)</i>

It can be observed in Table 5 that the prepaid electricity system empowers residents by providing control over energy consumption, similar to real-time monitoring offered by advanced systems like Synergy (Johnson et al., 2019). This allows users to track their electricity usage and costs, promoting responsible consumption. The immediate feedback, akin to smart meters, helps users adjust their habits to reduce costs and minimize environmental impact. The prepaid system also enables residents to budget more effectively, avoiding large debts, which aligns with the benefits of flexible consumption management as discussed by Charoen et al. (2019). It encourages active participation in demand-side management, allowing consumers to tailor their energy usage based on financial capacity, thus reducing the risk of unexpected bills, a benefit supported by Ogbuefi et al. (2019).

Moreover, the prepaid system's notification feature for low balances adds another layer of control, enabling users to anticipate outages and plan accordingly. This aspect mirrors the convenience of GSM-based energy meters that provide easy access to billing and consumption data (Jha et al., 2019), enhancing communication between consumers and providers. The system's design encourages responsible utility management, especially for families transitioning from informal settlements. It allows them to manage their utilities in a more structured way, fostering a responsible approach to consumption.

For low-income households, the prepaid system helps avoid unexpected costs by enabling users to pay in advance and track their usage in real-time, leading to lower overall expenses (Ray et al., 2019; Guma et al., 2022). Additionally, it mitigates the risk of disconnection by preventing the accumulation of debt, a crucial benefit for vulnerable families who may struggle with postpaid bills (Hamilton, 2021). The proactive approach of the implementing agency in addressing technical difficulties has also improved the overall user experience, contributing to financial stability and supporting sustainable living, especially for those transitioning into formal housing.

As presented in Table 6, the prepaid electricity system is designed to be flexible and efficient, particularly for informal settler families used to irregular utility access. Digital platforms like GCash provide easy top-up options, accommodating varying income levels and usage patterns, promoting digital inclusion despite challenges like the digital divide (Uy-Tioco, 2019). The system's design helps residents manage consumption and payments flexibly, improving access to electricity for low-income households (Mazzoni, 2019), while facilitating timely bill payments through GCash to prevent service interruptions (Enojas et al., 2023).

Efficient problem resolution is supported by encouraging residents to report issues directly through Meralco's customer service channels, streamlining the process. Clear communication is crucial for resolving technical concerns, as ineffective complaint management can lead to dissatisfaction and attrition (Stauss & Seidel, 2019). Digital customer service channels like Meralco's enhance responsiveness, similar to Virtual Customer Service Channels (Bacile et al., 2020), ensuring timely resolution of issues. However, challenges in navigating traditional and digital channels may arise (Madsen et al., 2019), requiring clear communication to maintain high customer satisfaction.

Table 5. Theme 5 Matrix

Theme 5	Code	Coded segments
Empowerment and Control over Energy Consumption	Control over usage	<i>"The prepaid system has positively impacted residents by providing them with more control over their electricity usage and costs, aligning with the goals of providing a stable and sustainable living environment for informal settlers"</i> (Implementing Agency)
	Nurturing responsible consumers	<i>"Prepaid electricity systems empower consumers to monitor and manage their consumption, leading to more efficient use and reducing the risk of bill shocks"</i> (Implementing Agency)

Table 6. Theme 6 Matrix

Theme 6	Code	Coded segments
User-Centric System Design	Encouragement to report issues	<i>"To address these, residents have been encouraged to report their issues directly to Meralco's customer service channels, which has led to more streamlined resolutions. The proactive approach in addressing these concerns has had a positive impact on overall resident satisfaction. Residents appreciate the swift response to common electrical failures and the clear guidance on how to handle technical issues with Meralco"</i> (Implementing Agency)
	Clear communication with Meralco	<i>"Moreover, fostering clear communication between residents and Meralco regarding technical issues will ensure that all concerns are addressed promptly"</i> (Implementing Agency)

User-Centric System Design	<i>"The system was designed to offer flexibility and efficiency, particularly for informal settler families who may have been used to irregular access to utilities"</i> (Implementing Agency) <i>"The system was tailored to provide residents with easy access to top-up options through digital platforms like Gcash, accommodating varying income levels and usage patterns"</i> (Implementing Agency)
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Part 3. Implementing Agency's Satisfaction Level on the Project Management of Prepaid Electricity

The prepaid electricity project at the NHA resettlement site received positive feedback across various phases, with overall ratings reflecting a *"very satisfactory"* (VS) assessment. As shown in Table 7, the application phase had a mean of 3.63 (SD=0.08), which was rated as *"very satisfactory"* (VS). This rating aligns with the findings of Wei and Chou (2019), who emphasized the importance of clear objectives and resource management in utility systems. The planning phase also received a high rating of 3.66 (SD=0.15), reflecting well-executed resource identification and risk mitigation strategies, key aspects that contributed to the project's success, as noted by Okombe et al. (2023).

In contrast, the implementation phase, with a mean of 2.97 (SD=0.24), was rated as *"satisfactory"* (S), highlighting some challenges in this phase. Respondents reported issues such as unexpected disconnections, technical problems, and the reliance on stable mobile signals, particularly in areas with poor network coverage. These challenges were consistent with the findings of Bloomer and Boateng (2024), who noted that residents in low-income areas often face technical difficulties with digital platforms for utility payments. Natarajan and Bhallamudi (2023) also identified coordination problems and resource limitations as common barriers to successful project execution, which were observed in this phase.

Despite these challenges, the monitoring and evaluation (M&E) phase received a mean rating of 3.63 (SD=0.14), which was also considered *"very satisfactory"* (VS). This rating reflects the importance of ongoing feedback and system improvements in ensuring project success. Ndayisaba and De Dieu Dushimimana (2023) emphasized that effective M&E, with clear objectives and measurable indicators, is crucial for monitoring performance and improving outcomes, a view supported by the positive feedback in this project's M&E phase.

Table 7. Summary of Implementing Agency's Satisfaction Level

Indicators	M	SD	DI
Application	3.63	0.08	VS
Planning	3.66	0.15	VS
Implementation	2.97	0.24	S
Monitoring and Evaluation	3.63	0.14	VS
Overall	3.47	0.09	VS

Legend: 3.25–4.00 Very Satisfactory (VS); 2.50–3.24 Satisfactory (S); 1.75–2.49 Dissatisfactory (D); 1.00–1.74 Very Dissatisfactory (VD); SD-Standard Deviation; DI-Descriptive Interpretation

Overall, the project was rated "*very satisfactory*" (VS) with a mean of 3.47 (SD=0.09), indicating that it met most of its objectives in terms of flexibility, accessibility, and ease of use, especially through digital platforms like GCash. However, the implementation phase's lower rating points to the need for improved technical support, better coordination, and more reliable service delivery. These findings suggest that while the conceptual framework of the prepaid electricity system was robust, further enhancements are needed in the execution phase to optimize the system's efficiency and address the challenges faced by low-income residents, particularly in terms of network reliability and digital literacy (Lucia, 2022).

Part 4. Residents' Level of Satisfaction on Prepaid Electricity Use

Table 8 shows that respondents rated the prepaid electricity system as "*very satisfactory*" across all dimensions, with an overall mean of 3.48. The highest mean score was for flexibility (Mean=3.55), reflecting its ability to allow users to adjust electricity usage and payments based on their financial needs. This aligns with research that highlights the importance of flexibility in boosting customer satisfaction, particularly for low-income households (Sorkun et al., 2020; Swanston, 2021).

Reliability also received a high rating (Mean=3.52), indicating that respondents trust the system to provide consistent service. Research supports that reliability in prepaid electricity systems fosters user trust and satisfaction (Mukherjee, 2019; Alao et al., 2022). Despite this, minor issues were noted with the system's reliability, such as occasional errors in loading processes and unexpected disconnections, reflected in the lowest reliability indicator (Mean=3.46).

Affordability (Mean=3.43) was rated very satisfactory, with respondents appreciating the flexibility in payment options, like GCash. However, some concerns arose regarding the financial burden of prepaid systems, especially during network outages (Mean=3.35), aligning with findings from Perera et al. (2021), which highlight affordability as a persistent challenge in low-income communities.

The availability of the system was also rated highly (Mean=3.44), with indicator 3 receiving the highest score (Mean=3.53), reflecting the system's wide reach. Nevertheless, some respondents reported issues with network coverage, as indicated by the lowest

availability indicator (Mean=3.38), which aligns with research showing the critical role of service availability in customer satisfaction (Alao et al., 2022; Gina, 2019).

In conclusion, the prepaid electricity system received strong ratings for reliability, affordability, availability, and flexibility. However, issues such as network connectivity and occasional technical difficulties should be addressed to further enhance customer satisfaction and ensure the system's effectiveness.

Part 5. Recommended Policies from the Experiences and Satisfaction Scores

The policy recommendation for prepaid electricity systems is critical in addressing implementation challenges. It involves creating actionable strategies and guidelines to improve existing services and meet consumer needs. Issues such as service disruptions, pricing transparency, user adaptation difficulties, and social inequities highlight the necessity for comprehensive policies that enhance service delivery and reliability. Well-formulated policies based on these findings can ensure prepaid electricity systems become more reliable, accessible, and equitable for all users. The recommended policies and specific actions are presented in the succeeding tables to provide clear guidance on addressing these challenges.

Based on the findings, delays in the loading process and power resumption are recurrent issues. This highlights the need for a policy that focuses on improving the technical infrastructure and support systems of the prepaid meters, as shown in Table 9, especially the reliability of mobile networks and the loading process. Such a policy would ensure that users have continuous access to electricity, particularly during emergencies, reducing the burden on consumers, especially those running small businesses. Enhancing the infrastructure and prepaid meters, incorporating system-integrated programs for error management, and setting up backup reloading facilities can significantly reduce outages and improve service reliability, ultimately leading to greater long-term satisfaction among residents.

Affordability remains a pressing concern, especially for low-income households and senior citizens, with many users facing hidden costs through third-party services or uncertainty in pricing models. As reflected in Table 10, a key recommendation is the introduction of pricing transparency policies and targeted subsidies for low-income families and elderly citizens. These policies should mandate clear communication on electricity pricing, ensuring that all users, especially vulnerable groups, fully understand the costs involved. Additionally, direct relief through discounted rates or rebate programs should be provided to these groups, promoting financial inclusivity and helping to prevent disconnection for families and seniors unable to top up regularly. Expanding support programs like Meralco K-load, with specific provisions for senior citizens and marginalized communities, would enhance access to affordable and sustainable electricity, ensuring that the needs of the most vulnerable populations are met.

Table 8. Summary of Resident's Satisfaction Level

Indicators	M	SD	DI
Reliability	3.52	0.47	VS
Affordability	3.43	0.58	VS
Availability	3.44	0.57	VS
Flexibility	3.55	0.49	VS
Overall	3.48	0.47	VS

Legend: 3.25–4.00 Very Satisfactory (VS); 2.50–3.24 Satisfactory (S); 1.75–2.49 Dissatisfactory (D); 1.00–1.74 Very Dissatisfactory (VD); SD-Standard Deviation; DI-Descriptive Interpretation

Table 9. Recommendations for Improving Service Efficiency and Stability

Recommendation	Specific Action	Responsible Parties
Upgrade Infrastructure	Install dedicated signal boosters or microcell towers in prepaid communities to improve stability and coverage.	Telecommunication Companies, Energy Providers
Upgrade Prepaid Meters	Conduct timely inspections and replace outdated or defective prepaid meters to prevent loading failures or disconnection.	Energy providers, NHA
Provide 24/7 Technical Support Team	Deploy a dedicated hotline (e.g., 8888-PREPAID) with trained personnel available round-the-clock to address prepaid electricity issues and loading errors.	Energy Providers, Customer Service Departments
Implement automated error detection and rollback features	Integrate a program into the current system for auto-reversal of failed loads and real-time notifications with error codes.	Energy Providers, IT Solutions Providers
Establish Backup Systems	Install solar-powered or diesel-powered backup kiosks in communities so they can reload for free during an emergency/crisis.	Energy Providers, Local Government Units (LGUs)
Integrate Automated Monitoring System	Install SCADA-based real-time fault detection systems to prevent delays and outages in prepaid electricity services.	Energy Providers, IT Solutions Providers

Table 10. Recommendations for Improving Pricing Transparency and Subsidies for Low-Income Families and Senior Citizens

Recommendation	Specific Action	Responsible Parties
Lower Threshold Bracket	Reduce the default equivalent kWh load bracket for low-income families to eliminate rate adjustments.	Energy Regulatory Commission (ERC), Energy Providers
Eliminate/Decrease Loading Charges	Provide payment channels with zero or minimal service charges to reduce the financial burden during reloading.	Energy Providers, Payment Platform Operators
Itemized Hidden Charges	Mandate clear itemization of all charges (e.g., VAT, service fees) on receipts and digital platforms for transparency.	Energy Providers, Government Regulators
Offer Targeted Subsidies	Offer electricity rate discounts to families under 4Ps and senior citizens certified by the Office of Senior Citizens Affairs (OSCA).	Department of Social Welfare and Development (DSWD), Energy Providers

Table 11. Recommendations for Improving Pricing Transparency and Subsidies for Enhancing Consumer Support and Financial Literacy Programs

Recommendation	Specific Action	Responsible Parties
Disseminate User Manual	Create and distribute detailed guides explaining prepaid electricity operations and energy-saving techniques.	Energy Providers, Local Government Units (LGUs)
Conduct Localized Workshops	Conduct workshops on budgeting and energy conservation, especially in barangays and communities.	LGUs, Non-Governmental Organizations (NGOs)
Enhance Mobile App Integration	Upgrade electricity apps to include calculators for energy usage, budgeting tools, and FAQs.	Energy Providers, Software Developers
Set Up Consumer Support Hotline	Set up a toll-free, multilingual hotline to resolve user complaints promptly.	Energy Providers, Customer Service Departments

The analysis indicates that many users, especially older and lower-income residents, need help managing their consumption effectively due to the complexities of the prepaid system. In Table 11, a robust consumer support and financial literacy program is recommended to address this issue. This program should focus on educating users about the prepaid system's functionality, guiding them on budgeting, energy-saving practices, and how to monitor their electricity consumption efficiently. This policy will encourage responsible consumption, reduce unexpected disconnections, and prevent debt accumulation by enhancing energy management skills and building user confidence. Additionally, clear communication strategies and accessible, user-friendly tools should be introduced, ensuring that all demographics, particularly vulnerable groups, are well-informed and empowered to manage their electricity use effectively.

Prepaid electricity has empowered many beneficiaries by giving them control over their energy usage and reducing the risk of electricity theft. However, the findings highlight the need for social equity policies to support low-income households and ensure their smooth integration into the prepaid system, as outline in Table 12. This policy should improve access to affordable top-up amounts and service fees and provide flexible payment options for unstable-income families. Additionally, Meralco should work on increasing public awareness of available support programs that can encourage and promote the implementation of prepaid electricity. Promoting equal access to prepaid electricity will foster inclusive growth and help improve living conditions for beneficiaries in resettlement sites. Initiatives such as rebates, discounts, or other financial relief measures can help mitigate economic barriers, ensuring that low-income families can access essential electricity services without hardship.

Users have raised concerns about the adaptation to the prepaid system, particularly regarding automatic disconnection and the delay of notifications when credit is low or the absence of notifications when price adjustments occur. In Table 13, a crucial recommendation is implementing an enhanced notification system that alerts users when their balance is running low, allowing sufficient time to reload before disconnection occurs. The policy should also address protection against automatic disconnection during critical times, such as nighttime or emergencies, or when there are typhoons and calamities, to prevent significant disruptions and protect the well-being of the individuals. Additionally, it should consider incorporating alerts for price adjustments, as users sometimes face unexpected disconnections even with sufficient load due to these price changes. Regular user feedback collection should be integrated to continuously refine the prepaid electricity system, ensuring it remains responsive to user needs and challenges. This policy will help alleviate consumer stress, promote smoother adaptation to the prepaid system, and give users better control over their electricity consumption. To keep the system responsive to user needs, regular feedback mechanisms should be established, such as mobile apps, SMS surveys, barangay consultations, and online platforms. These tools enable real-time input, foster community engagement, and support continuous system improvement, ultimately helping users adapt and manage their electricity consumption more effectively.

Table 12. Recommendations, Specific Actions, and Responsible Parties for Strengthening Social Equity and Access to Prepaid Electricity Programs

Recommendation	Specific Action	Responsible Parties
Provide Affordable Top-Up Amounts	Lower the minimum top-up to P50 to ensure low-income households can access prepaid electricity.	Energy Providers, ERC
Develop "Pay Later" Plans	Develop flexible payment schemes for families with unstable incomes, allowing payment within a penalty-free grace period.	Energy Providers, Social Services Departments
Provide Energy-Efficient Appliance Discounts and Promotions	Provide rebates or discounts for energy-efficient appliances, such as LED bulbs or inverters, to promote sustainable energy use.	Energy Providers, Appliance Retailers
Organize Community Awareness Campaigns	Organize campaigns to inform the public about rebates, subsidies, and payment plans for prepaid electricity users.	LGUs, NGOs, Energy Providers

Table 13. Recommendations for Improving Pricing Transparency and Subsidies for Addressing Service Adaptation and Notification Systems

Recommendation	Specific Action	Responsible Parties
Deploy Enhanced Real-Time Monitoring and Notification System	Deploy systems that send alerts for upcoming price adjustments and when the load balance falls to the allowable minimum load threshold via SMS or mobile apps.	Energy Providers, IT Solutions Providers
Implement Automatic Disconnection Protection	Implement mechanisms to delay disconnection during emergencies, nighttime, or typhoons by providing temporary credit.	Energy Providers, ERC

Allow Grace Period for Reloading During Calamities	Permit a grace period after balance depletion, ensuring uninterrupted power for senior citizens, PWDs, and low-income households.	Energy Providers, Local Disaster Committees
Introduce mobile apps and SMS-based feedback channels	Set up user-friendly reporting features for issues and customer satisfaction, like push surveys after a transaction.	Energy Providers, Application Developers
Conduct annual barangay-based consultation meetings	Facilitate focus group discussions and policy feedback loops to cater to the changing needs of the community.	Energy Providers, Barangay Councils, LGUs, NHA
Launch web portals and social media channels	Use Facebook/website to gather suggestions and to provide live chat or helpdesk.	Energy Providers, IT Solutions Providers/Web Developers

Conclusion and Recommendation

The study concludes that the prepaid electricity system at the NHA Resettlement Site in Caloocan City has both positive and negative impacts. While it offers benefits like better control over consumption, energy discipline, and flexible payments, challenges such as automatic disconnections, delays, and technical issues with mobile networks affect user experience, especially for lower-income and older residents. Despite a very satisfactory rating in planning, monitoring, and evaluation, the implementation phase faced difficulties, particularly with technical problems. Residents rated the system highly in flexibility, reliability, and availability, but concerns about affordability and access to government subsidies remain. Addressing these issues will improve user satisfaction and ensure long-term success and sustainability.

Based on the conclusions, the following are recommendations of the study:

1. Engage local stakeholders in the implementation of prepaid electricity policy changes to foster strong community involvement and ensure that solutions are responsive and tailored to the specific needs and conditions of each locality. This participatory approach will promote better system adoption, smoother implementation, and increased trust between residents and service providers.
2. The National Housing Authority (NHA) should enhance prepaid electricity programs based on ongoing feedback from residents to continuously align the system with actual user experiences and evolving needs.

3. Policymakers should simplify the pricing structure and eliminate third-party service charges to make prepaid electricity more affordable, transparent, and accessible, particularly for low-income users.
4. Financial education programs should be introduced to help residents develop energy budgeting skills, increase awareness of consumption patterns, and make more informed decisions about electricity usage.
5. The reloading process should be improved through more user-friendly mobile apps, the expansion of reloading stations, and the reduction of dependence on third-party service providers that often cause delays and extra costs.
6. Tailored support must be provided to vulnerable groups, especially senior citizens and low-income households, by designing inclusive programs that ensure equitable access, simplified services, and easier access to services.

References

- Alao, K., Jimoh, K., & Obadiora, A. J. (2022). Evaluation of customer education and satisfaction of prepaid meter usage in Nigeria Electricity distribution company. *Journal of Digital Learning and Education*, 2(1), 31–41. <https://doi.org/10.52562/jdle.v2i1.323>
- Bacile, T. J., Krallman, A., Wolter, J. S., & Beachum, N. D. (2020). The value disruption of uncivil other-customers during online service recovery. *Journal of Services Marketing*, 34(4), 483–498. <https://doi.org/10.1108/jsm-05-2019-0209>
- Baldwin, S., & Tallackson, H. (2023, September 25). States, utilities prioritize energy affordability to lower consumer bills amid Inflation Reduction Act and clean energy goals. *Utility Dive*. Retrieved September 28, 2024, from <https://www.utilitydive.com/news/states-utilities-energy-affordability-lower-consumer-bills-inflation-reduction-act-clean-energy/638679/>
- Bloomer, J., & Boateng, D. (2024). Prepaid into poverty? Exploring energy poverty and access to alternative electricity sources among urban poor households in Ghana. *Energy Research & Social Science*, 112, 103510. <https://doi.org/10.1016/j.erss.2024.103510>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp0630a>
- Buono, R., Smith, L., & Thompson, H. (2019). Prepaid electricity metering and consumer behavior: A study in urban Ghana. *Utilities Policy*, 59, 100926. <https://doi.org/10.1016/j.jup.2019.100926>
- Charoen, P., Sioutis, M., Javaid, S., Charoenlarnopparut, C., Lim, Y., & Tan, Y. (2019). User-Centric consumption scheduling and fair billing mechanism in Demand-Side management. *Energies*, 12(1), 156. <https://doi.org/10.3390/en12010156>

- Cominola, A., Giuliani, M., Piga, D., Castelletti, A., & Rizzoli, A. E. (2021). A hybrid metamodel for predicting the impact of behavioural responses to information feedback on water consumption. *Resources, Conservation and Recycling*, 128, 49–59.
- Enojas, M. J. B., Morgado, J. E., Bongao, H. L., Arribas, R. G., Damiles, C., Talon, K. J. Z. N., & Turallo, L. M. M. (2023). User perception of a developed GCash cash-in and cash-out machine in the Philippines. *Indonesian Journal of Electrical Engineering and Computer Science*, 32(1), 328. <https://doi.org/10.11591/ijeecs.v32.i1.pp328-334>
- Gina, M. (2019). Customer satisfaction analysis of Conlog electricity prepayment meters in KwaZulu-Natal: a customer perspective. <https://doi.org/10.51415/10321/2905>
- Guma, P. K., Monstadt, J., & Schramm, S. (2022). Post-, pre- and non-payment: Conflicting rationalities in the digitalisation of energy access in Kibera, Nairobi. *Digital Geography and Society*, 3, 100037. <https://doi.org/10.1016/j.diggeo.2022.100037>
- Hamilton, L. (2021). Asset limits in public assistance and savings behavior among Low-Income families. *Social Science Quarterly*, 102(1), 454–467. <https://doi.org/10.1111/ssqu.12874>
- Huang, S., Weng, S., Chiou, S., Nguyen, T., Chen, C., Liu, S., & Tsai, Y. (2024). A study on Decision-Making for Improving Service Efficiency in Hospitals. *Healthcare*, 12(3), 405. <https://doi.org/10.3390/healthcare12030405>
- Hung-Yu, Wei., Ching-Chun, Chou. (2019). Methods and related devices for resource allocation.
- Jha, P. V., Savla, K. R., Patwa, D. K., Deshmukh, A. A., & Pistolwala, S. T. (2019). Portal Based Prepaid Energy Billing System Using GSM (pp. 1–5). <https://doi.org/10.1109/icnte44896.2019.8946104>
- Johnson, J. X., St. John, J., & Faruqui, A. (2019). The impact of prepaid electricity on energy consumption: Evidence from South Africa. *Energy Economics*, 81, 101–111. <https://doi.org/10.1016/j.eneco.2019.03.005>
- Kambule, N., & Nwulu, N. (2021). Prepaid Electricity Meters and Energy Poverty—Lessons from South Africa (pp. 55–76). https://doi.org/10.1007/978-3-030-71217-4_4
- Lim, J. S., & de Guzman, S. A. (2021). Prepaid electricity systems and consumer consumption patterns. *Journal of Consumer Research*, 35(4), 120-135.
- Lomax, E., & Ritchie, S. (2024). The challenges of prepaid electricity systems. *Energy Research & Social Science*, 83, 103510. <https://doi.org/10.1016/j.erss.2024.103510>
- Lucia, Mendonca, Morato, de, Andrade. (2022). 3. Financial Vulnerability, Financial Literacy, and the Use of Digital Payment Technologies. *Journal of Consumer Policy*.

- Madsen, C. Ø., Hofmann, S., & Pieterse, W. (2019). Channel choice complications. In *Lecture notes in computer science* (pp. 139–151). https://doi.org/10.1007/978-3-030-27325-5_11
- Maina, S. (2020). The benefits and challenges of prepaid metering. University of Nairobi Repository. <http://erepository.uonbi.ac.ke/handle/11295/154275>
- Malterud, K., Siersma, V. D., & Guassora, A. D. (2016). Sample size in qualitative interview studies. *Qualitative Health Research*, 26(13), 1753–1760. <https://doi.org/10.1177/1049732315617444>
- Mathieu, V. (2022). Managing service operations. *International Journal of Productivity and Performance Management*, 189–200. <https://doi.org/10.1002/9781119902430.ch11>
- Mazzoni, D. (2019). Digitalization for energy access in Sub-Saharan Africa: Challenges, opportunities and potential business models. <https://hdl.handle.net/10419/211161>
- Meralco. (n.d.). Features and benefits of prepaid electricity. Retrieved from <https://www.meralco.com.ph/residential/electric-service/prepaid-electricity/features-and-benefits>
- Mukherjee, S. P. (2019). Reliability — An extension of quality. In *India studies in business and economics* (pp. 331–357). https://doi.org/10.1007/978-981-13-1271-7_16
- Natarajan, A., & Bhallamudi, S. M. (2023). Implementation challenges for new projects and technologies. In *IWA Publishing eBooks* (pp. 275–283). https://doi.org/10.2166/9781789063714_0275
- Ndayisaba, P. R., & De Dieu Dushimimana, J. (2023). Role of monitoring and evaluation practices to the successful implementation of projects: A Case of Health Post project in Musanze District, Rwanda. *Journal of Entrepreneurship & Project Management*, 7(10), 22–40. <https://doi.org/10.53819/81018102t2209>
- Obilor, E. (2023). Convenience and purposive sampling techniques: are they the same? *International Journal of Innovative Social & Science Education Research*, 11(1).
- Ogbuefi, U., Ene, P., & Okoro, P. (2019). Prepaid meter tariffing for actual power consumption in an average house hold: A case study of Nigeria DISCOs. *Nigerian Journal of Technology*, 38(3), 750. <https://doi.org/10.4314/njt.v38i3.29>
- Okombe, L. A., Gichuhi, K., Njuguna, J. N., & Obunga, F. (2023). Quality planning and project success in electricity supply infrastructure projects in Kenya; a case of transmission infrastructure projects. *European Scientific Journal ESJ*, 19(25), 53. <https://doi.org/10.19044/esj.2023.v19n25p53>
- Perera, P., Sarker, T., Bélaïd, F., Hesary, F. T., & Islam, K. M. N. (2021). How Precious Is the Reliability of the Residential Electricity Service in Developing Economies? Evidence from India. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3798084>

- Ponce, O. A. (2022). The emergence of mixed methods in educational research. In *Introduction to the Philosophy of Educational Research* (pp. 61–68). *River Publishers*.
<https://doi.org/10.1201/9781003338697-5>
- Rabbani, S. B., Ali, A. A., & Zaber, M. (2020). Does electric prepaid meters decrease payment delinquency? Evidence from data-centric analysis of electricity consumption in Dhaka, Bangladesh. 2020 IEEE Region 10 Symposium (TENSYP), 1636–1639.
<https://doi.org/10.1109/TENSYP50017.2020.9230814>
- Ray, A., Wang, R., Nguyen, D., Martinez, J., Taylor, N., & Searcy, J. K. (2019). Household energy costs and the Housing Choice Voucher Program: Do utility allowances pay the bills? *Housing Policy Debate*, 29(4), 607–626.
<https://doi.org/10.1080/10511482.2019.1566158>
- Sardianos, C., Doukas, H., Marinakis, V., & Psarras, J. (2020). Real-time personalised energy saving recommendations. 2020 *International Conferences on Internet of Things (iThings) and IEEE GreenCom*, 366–371. <https://doi.org/10.1109/iThings-GreenCom-CPSCo-SmartData-Cybermatics50389.2020.00072>
- Sharma, L. R., Bidari, S., Bidari, D., Neupane, S., & Sapkota, R. (2023). Exploring the mixed methods research design: Types, purposes, strengths, challenges, and criticisms. *Global Academic Journal of Linguistics and Literature*, 5(1), 3–12.
<https://doi.org/10.36348/gajll.2023.v05i01.002>
- Sorkun, M. F., Hüseyinoğlu, I. Ö. Y., & Börühan, G. (2020). Omni-channel capability and customer satisfaction: mediating roles of flexibility and operational logistics service quality. *International Journal of Retail & Distribution Management*, 48(6), 629–648.
<https://doi.org/10.1108/ijrdm-07-2019-0235>
- Stauss, B., & Seidel, W. (2019). Effective complaint management. In *Management for professionals*. <https://doi.org/10.1007/978-3-319-98705-7>
- Swanston, B. (2021). Prepaid electricity and energy justice: A critical review. *Energy Research & Social Science*, 76, 102059. <https://doi.org/10.1016/j.erss.2021.102059> ScienceDirect
- Uy-Tioco, C. S. (2019). ‘Good enough’ access: digital inclusion, social stratification, and the reinforcement of class in the Philippines. *Communication Research and Practice*, 5(2), 156–171. <https://doi.org/10.1080/22041451.2019.1601492>
- Wangui, J. (20219). Effect of prepaid meters on revenue collection at Kenya Power and Lighting Company [Master's dissertation, KCA University].
- Wohllebe, A. (2020). Consumer Acceptance of App Push Notifications: Systematic Review on the Influence of Frequency. *International Journal of Interactive Mobile Technologies (ijIM)*, 14(13), pp. 36–47. <https://doi.org/10.3991/ijim.v14i13.14563>

Zhang, F., Luo, F., Dong, Z., Liu, Y., & Ranzi, G. (2020). Hierarchical energy management scheme for residential communities under grid outage event. *IET Smart Grid*, 3(2), 174–181. <https://doi.org/10.1049/iet-stg.2019.0150>